Standard Model Fields as Emergent Excitations of Spacetime: A Mechanism from the Grand Unified Field Theory of Asymmetry

James Scott Trimm

Independent Researcher
Contact: jstrimm@protonmail.com

July 6, 2025

Abstract

We propose a mechanism for the emergence of Standard Model (SM) fields from the coherent phase of the Dark Energy Quantum Field (DEQF), in which spacetime and gravity are already unified via the graviton quantum field (GQF). Within this framework, gauge fields and matter particles arise as coherent excitations and topological defects in the DEQF condensate. This view dissolves the traditional hierarchy between quantum fields and geometry and suggests a unified ontological substrate beneath both spacetime and matter. We explore the implications for symmetry breaking, anomaly cancellation, and coupling structure.

1 Introduction

The Grand Unified Field Theory (GUFT) of Asymmetry reinterprets gravity not as a fundamental force, but as an emergent effect of virtual graviton density in the spacetime phase of the Dark Energy Quantum Field (DEQF). Previous work has shown how this formulation yields spacetime itself and explains dark matter phenomena.

In this paper, we propose a natural extension: the fields of the Standard Model (SM) also emerge from the DEQF, not as fundamental constructs, but as excitation patterns and defects in the same quantum substrate that gives rise to spacetime. This yields a deeper unification wherein geometry and matter are simply different coherent organizations of the same field.

2 DEQF as Ontological Substrate

The DEQF is postulated as a universal quantum field with the following key properties:

- It admits coherent phases that yield spacetime and gravitational structure.
- It supports topological defects and localized modes with gauge symmetry.
- It governs both short-range (quantum) and large-scale (cosmological) dynamics.

We propose that the Standard Model fields are emergent features of the DEQF condensate—specifically:

- Gauge bosons arise as phase-connected field modes mediating local symmetry.
- Fermions arise as topological defects (e.g., vortices or skyrmions) with chiral structure.
- The Higgs field arises as a scalar modulation of DEQF coherence.

3 Emergent Gauge Symmetry and Particle Structure

In the condensed DEQF phase corresponding to spacetime, residual symmetry-breaking processes may yield local gauge structures:

$$G_{\text{DEQF}} \to SU(3)_C \times SU(2)_L \times U(1)_Y \tag{1}$$

where G_{DEQF} is the full internal symmetry group of the DEQF in the uncondensed phase.

Chiral fermions may then arise as topological configurations that break parity symmetry, stabilizing their handedness via interaction with the emergent graviton vacuum.

4 Higgs Mechanism and Mass Generation

The Higgs field is proposed to be a scalar excitation of the DEQF condensate amplitude. Mass arises not from intrinsic properties, but from local coherence distortion:

$$m \sim \lambda \langle \phi_{\text{DEQF}} \rangle \tag{2}$$

where ϕ_{DEQF} is the local scalar modulation of the DEQF and λ is an effective coupling. The conventional Higgs boson is a manifestation of this scalar order parameter.

5 Anomaly Cancellation and Effective Symmetries

Because gauge symmetry is emergent, its preservation depends on the topological consistency of DEQF modes. Anomaly cancellation becomes a geometric constraint:

$$\sum Q^3 = 0 \quad \Rightarrow \quad \text{cohomology constraint on defect structure} \tag{3}$$

indicating that only certain matter generations and charges are topologically permissible in the coherent DEQF phase.

6 Implications and Predictions

- **Nonlinear field mixing:** SM particles may interact via DEQF coherence effects beyond standard couplings.
- **Deviation at high curvature:** SM behavior may be altered in strong gravity regions due to coupling with the graviton condensate.
- **Unified field origin:** A common origin for both spacetime and particle fields implies deeper symmetries or dualities yet to be uncovered.

7 Conclusion

The GUFT framework offers not only a quantum-consistent origin of spacetime and gravity but also a unified origin of matter and gauge fields. If correct, this emergent ontology dissolves the classical division between matter and geometry, yielding a coherent view where all fields arise from the same dark energy substrate.

References

[1] James Scott Trimm, *Spacetime as an Emergent Bubble Within a Fundamental Dark Energy Quantum Field*, Independent Research, 2025.

[2] James Scott Trimm, *Virtual Graviton Density and the Dark Matter Phenomenon: A Predictive Framework from the Grand Unified Field Theory of Asymmetry*, Independent Research, 2025.

[3] James Scott Trimm, *Black Hole Structure and Thermodynamics in the Grand Unified Field Theory of Asymmetry*, Independent Research, 2025.